

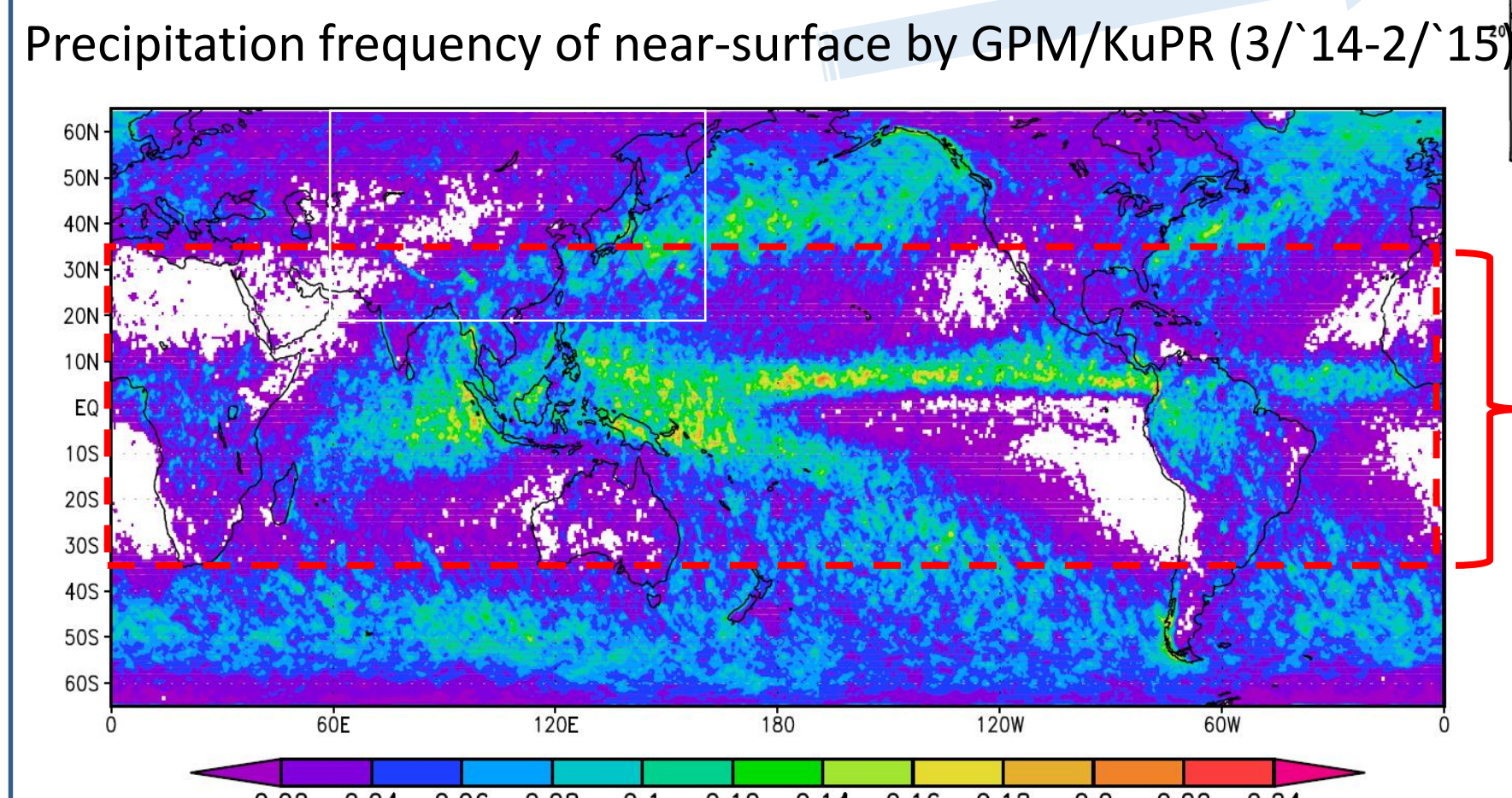
# Comparison of Vertical Precipitation Profiles in Tropical and Midlatitude Stratiform Regions

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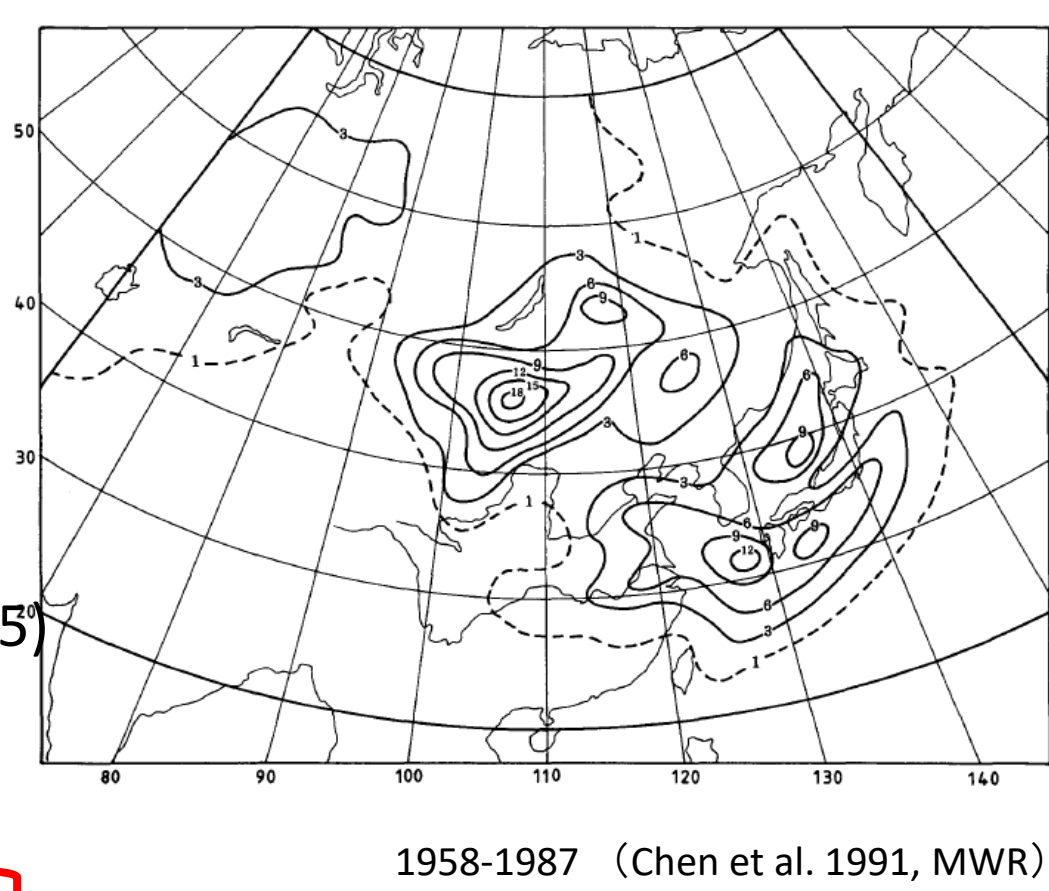
Poster #229

## 1. Introduction

Operating the GPM Core Observatory, an observable area of a spaceborne precipitation radar extended from tropic and subtropic regions (~35N-35S) by TRMM/PR to middle and high latitude (~65N-65S). Different precipitation systems dominate tropical rain and midlatitude rain.



The frequency of occurrence of the extratropical cyclone [/month]



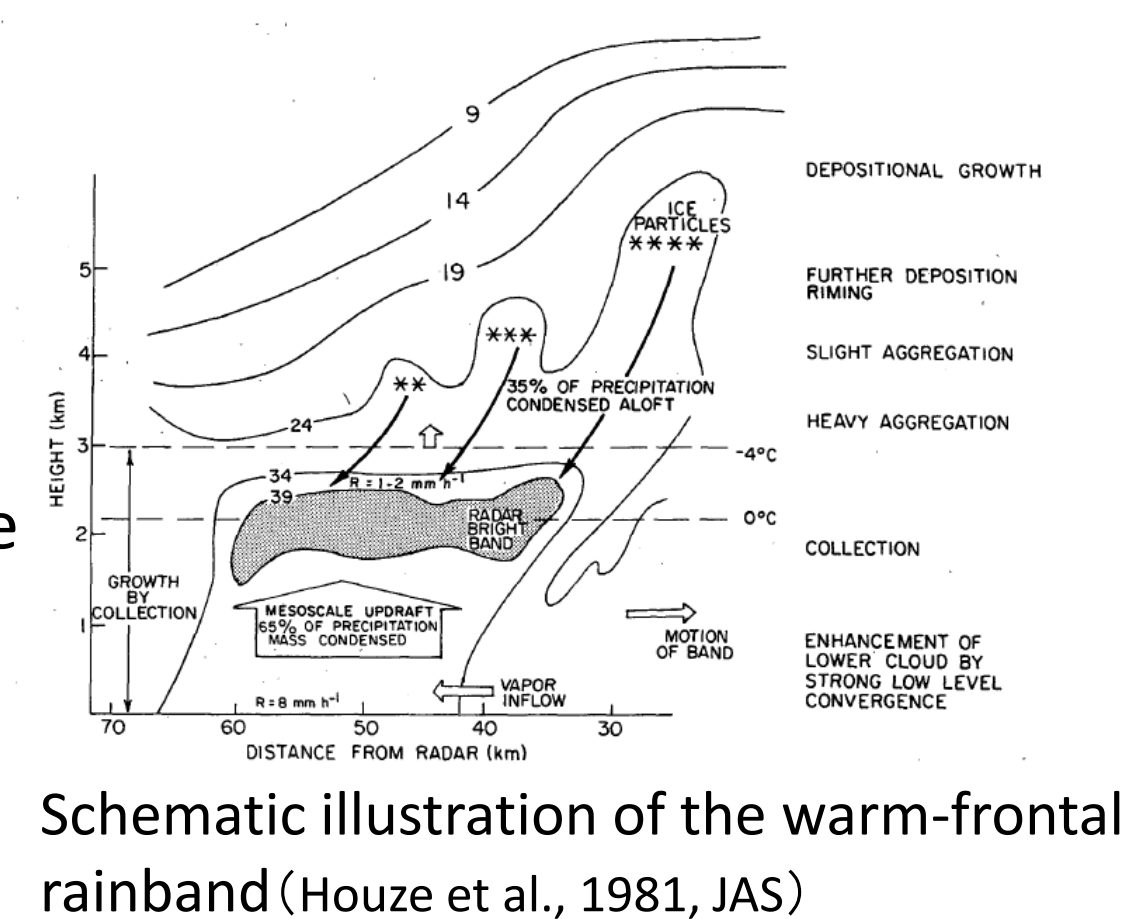
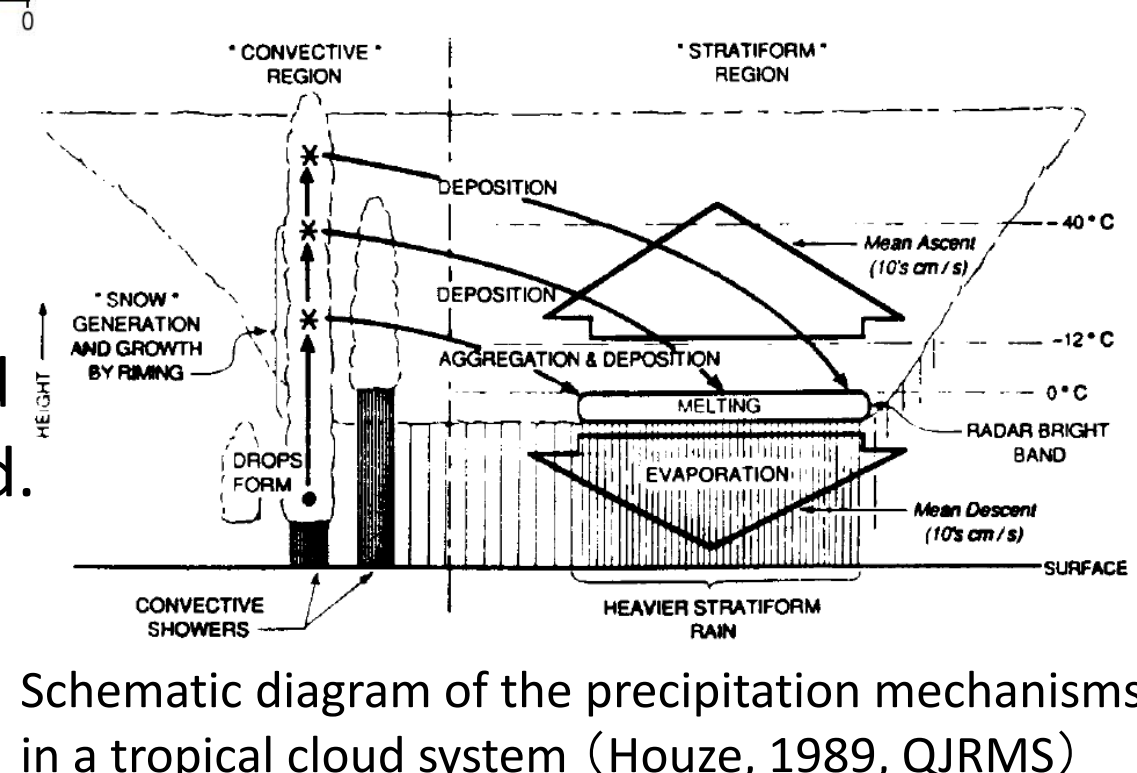
Range of observations by TRMM (N35-S35)

### <Stratiform rain in tropics>

In tropical mesoscale convective system (MCS), low density ice particles from convective cells are carried laterally into the stratiform region by horizontal wind. These particles grow up by deposition, aggregation and riming above a melting layer. While raindrops evaporate below the melting layer. Thus tropical stratiform rain cools the lower atmosphere.

### <Stratiform rain in a warmfront>

In stratiform regions of warm-frontal rainband, ice particles are produced by generating cells above a melting layer. Houze et al. (1981) showed that cloud water was produced by mesoscale updraft below the melting layer, and rainwater content increased there by scavenging of cloud water by precipitation particles in a warm-frontal rainband.



### ■ Purpose of this study

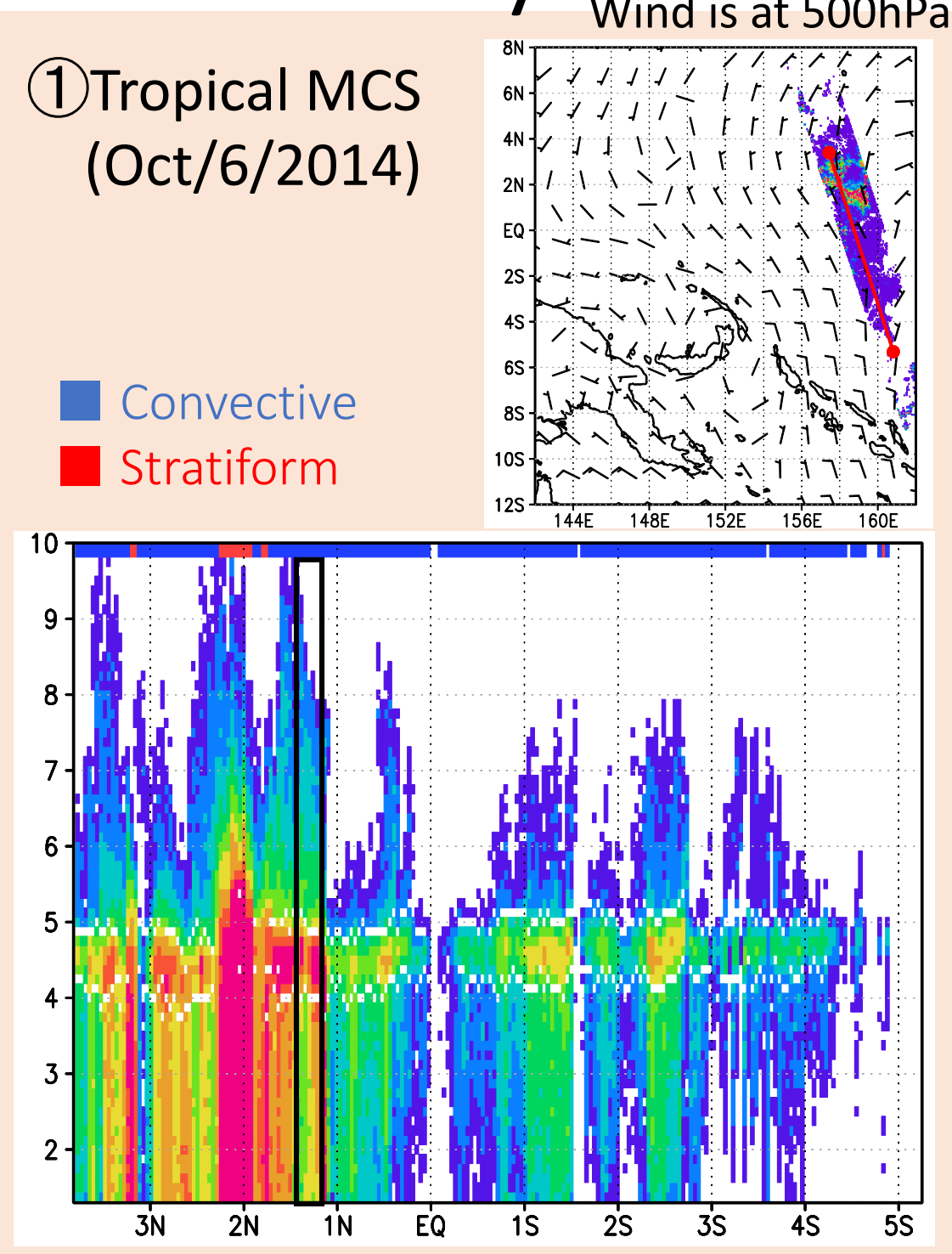
This study investigated characteristics of equivalent radar reflectivity profiles classified into stratiform rain with a bright band by a product, focusing on precipitation systems and regions, using a GPM Ku-band precipitation radar (KuPR) product.

## 2. DATA

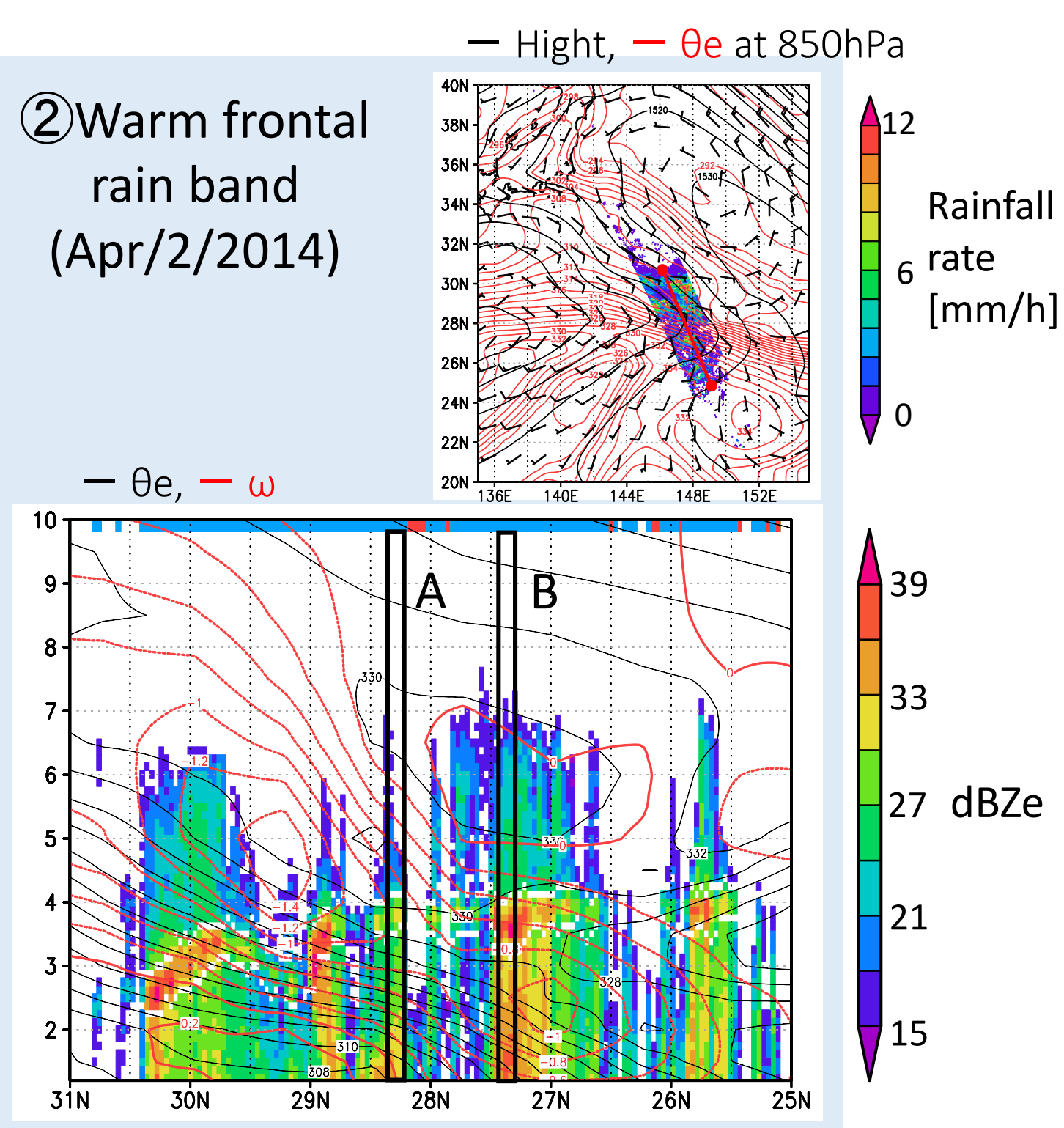
Satellite data : Equivalent radar reflectivity factor : Ze (GPM/KuPR, ver03 or ITE04)  
\*Using detected a bright band and classified into stratiform as stratiform rain.  
Reanalysis data : T, U, V, W, S (Specific humidity) (ERA-Interim, Daily/ECMWF)  
Resolution : 6 hours, 0.75° × 0.75° , 23 layers (1000hPa-200hPa)

## 3. Case study

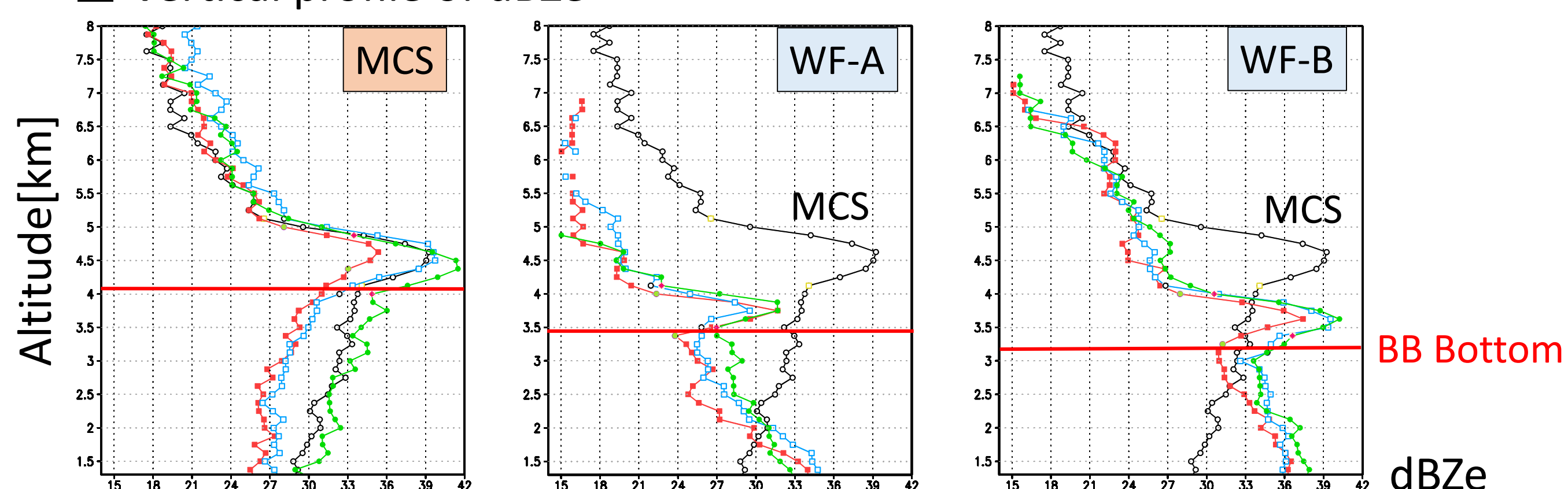
① Tropical MCS (Oct/6/2014)



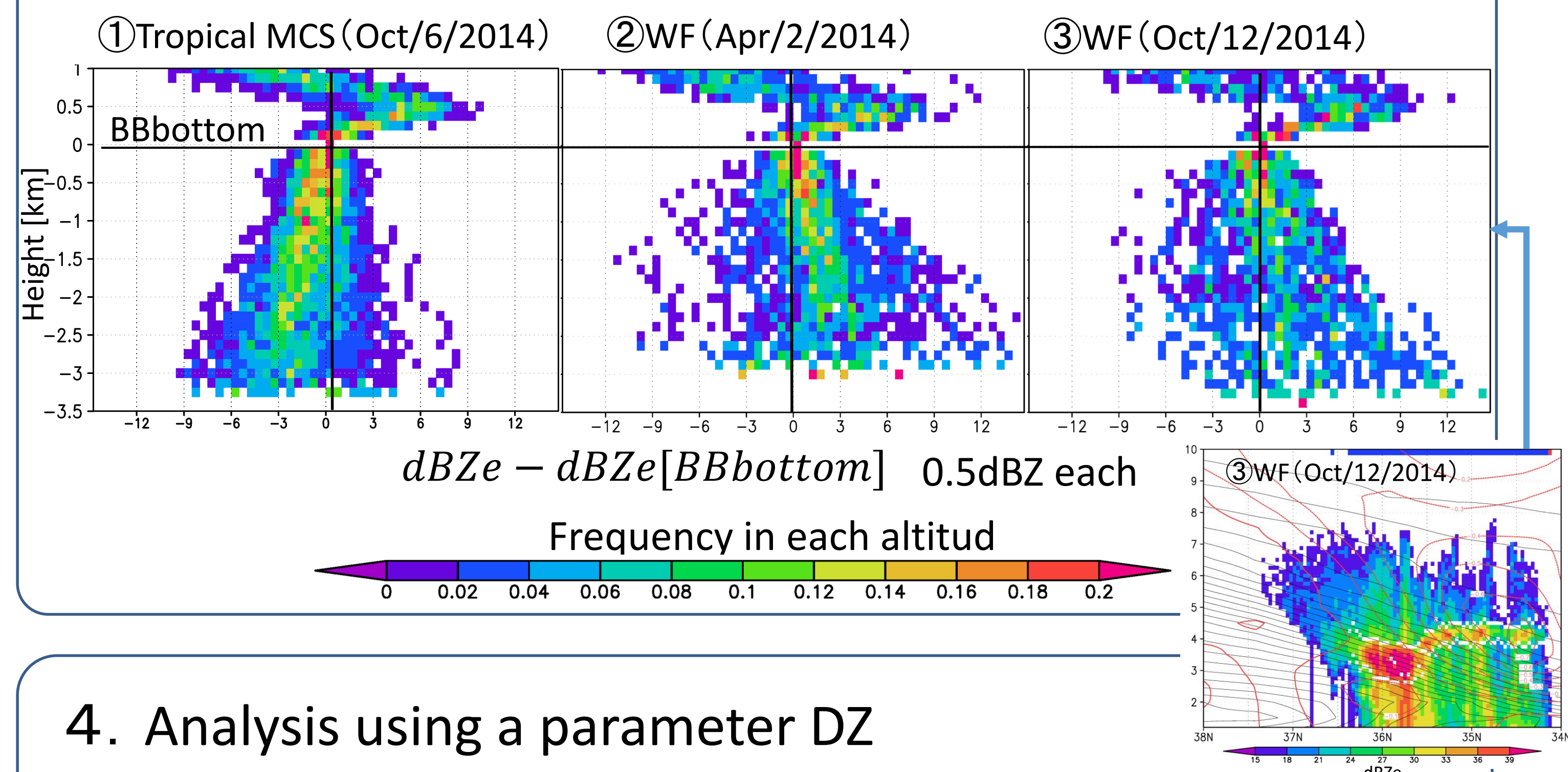
② Warm frontal rain band (Apr/2/2014)



### ■ Vertical profile of dBZe



## ■ Histogram of the dBZe profiles

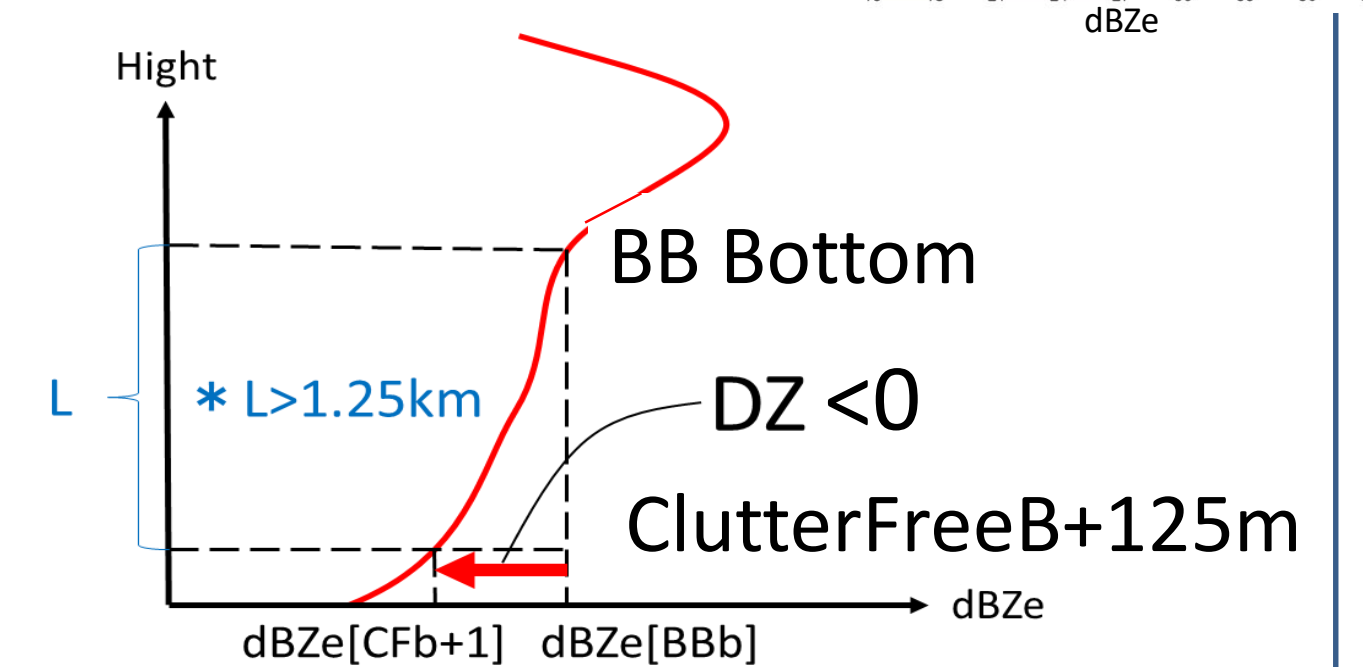


## 4. Analysis using a parameter DZ

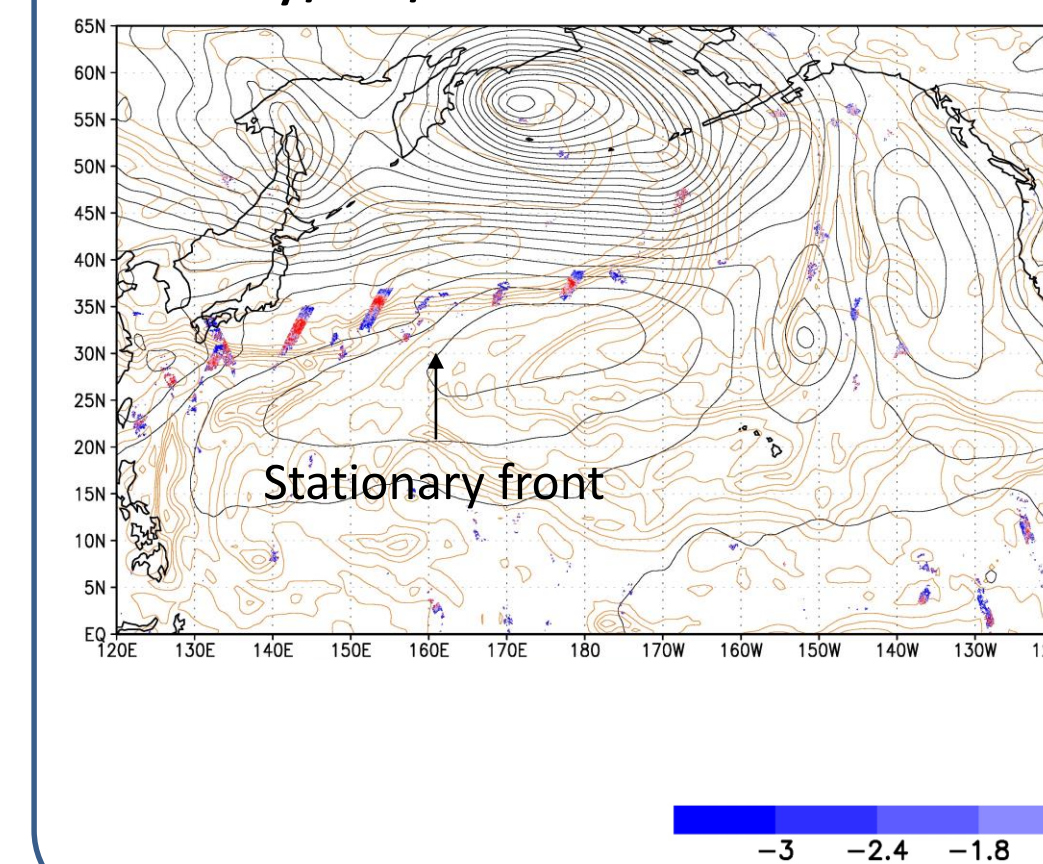
### ■ Definition of DZ

$$DZ \equiv dBZe[CFb + 1] - dBZe[BBb]$$

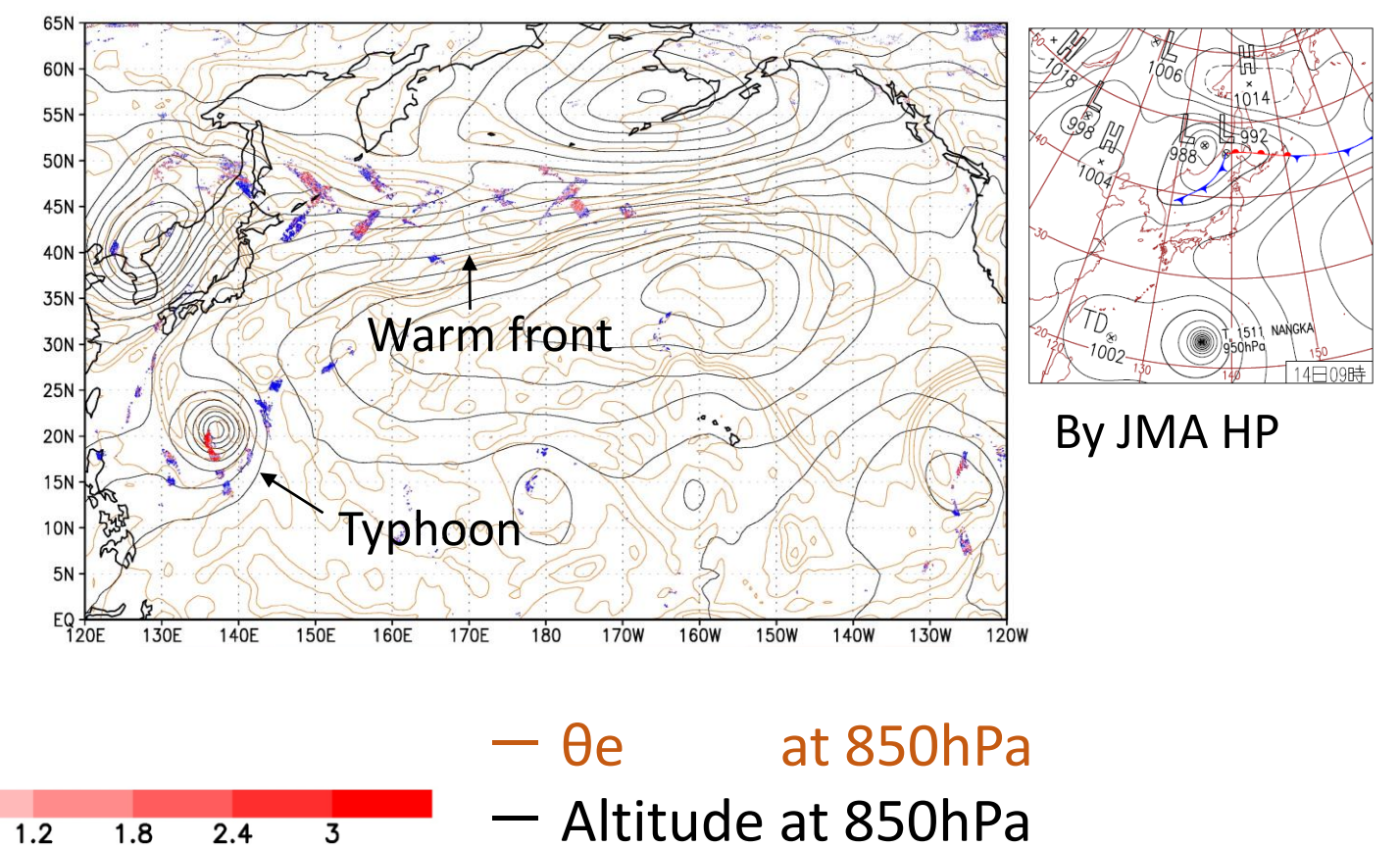
### ■ Horizontal distribution of DZ in a precipitation system



May/23/2015 before and after 3 days

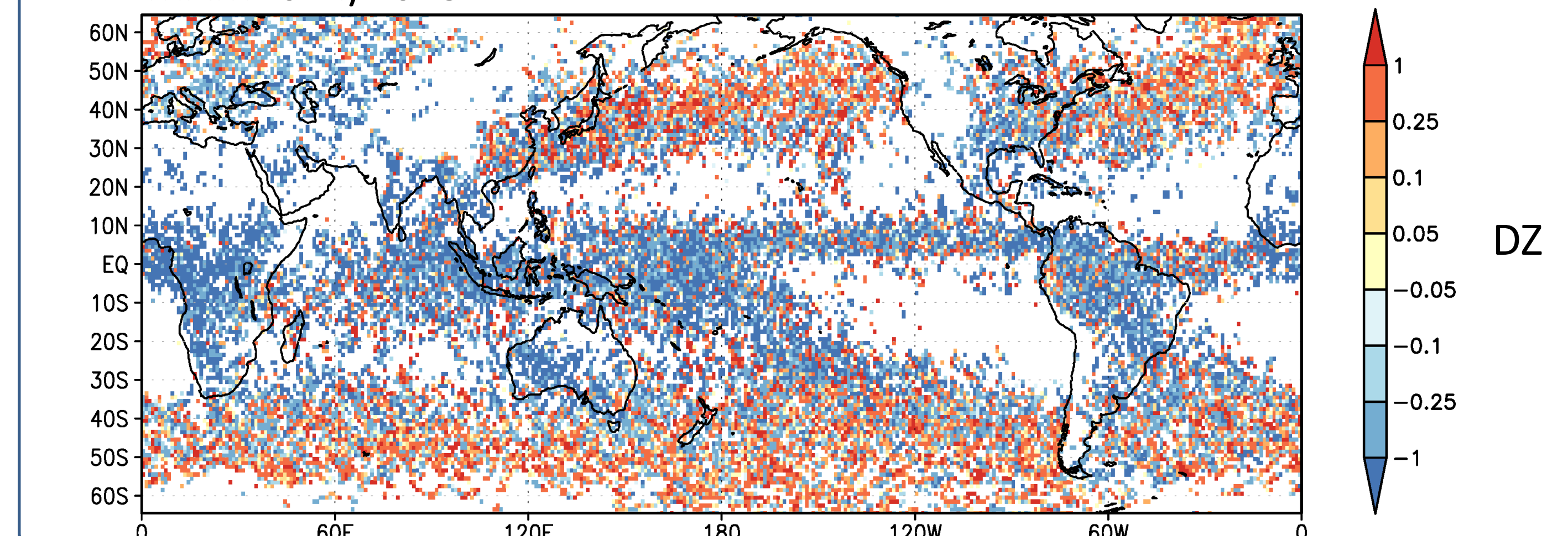


Jul/13/2015 before and after 3 days

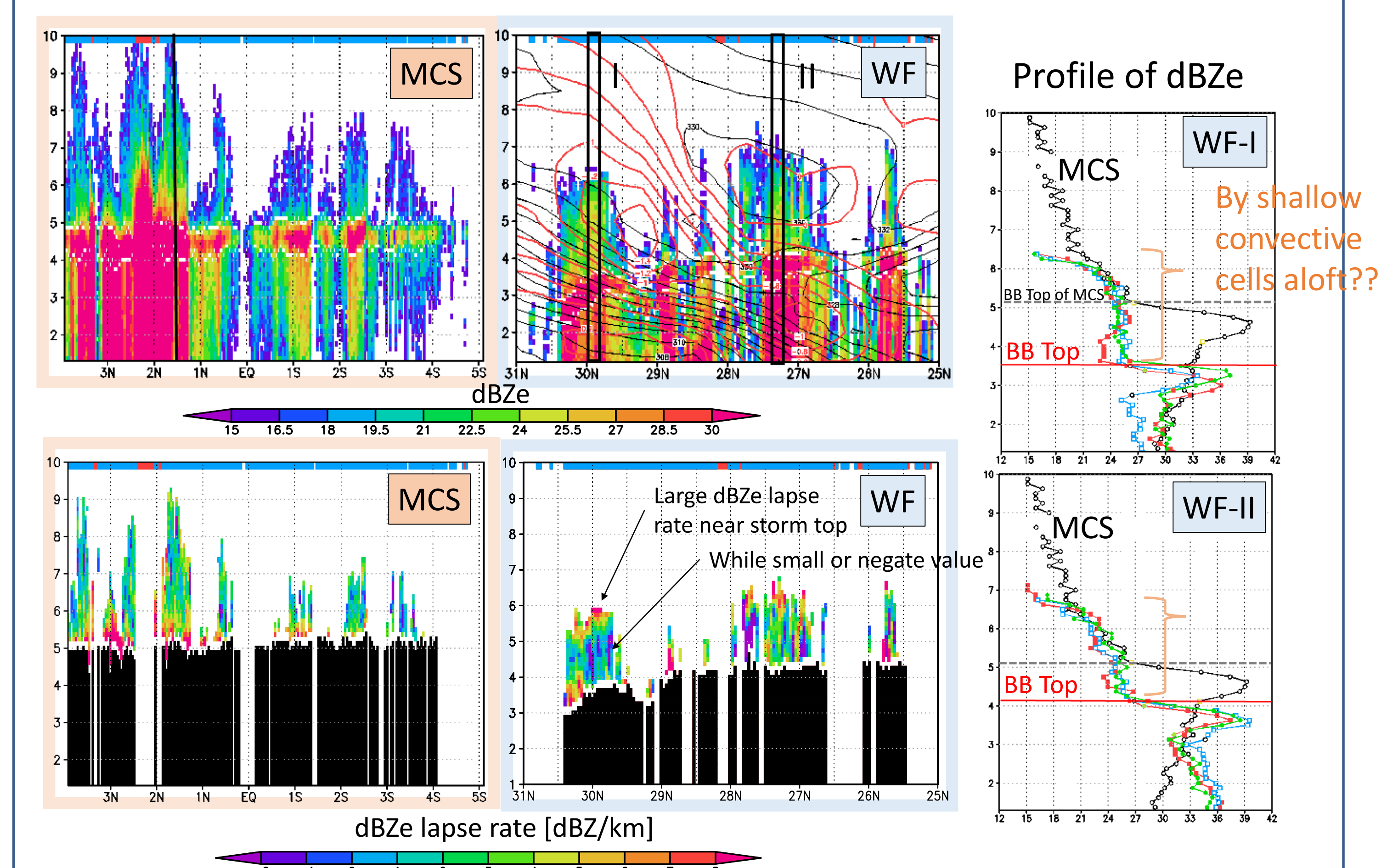


## 5. Global distribution of DZ (dBZe[CFb+1]>18)

MAM2014/2015



## Appendix: Difference of Ze profiles above a bright band



These differences of Ze profiles may be associated with presence or absence of generating cells.

## 6. Summary

It is found that there are differences in radar reflectivity profiles below a melting layer between tropical MCSs and warm fronts (stationary fronts and typhoon), even though they are classified as a same stratiform rain type by a GPM/KuPR algorithm. Ze decrease downward below a melting layer in stratiform regions of tropical MCSs, implying evaporation of raindrops, while it increase downward in warm fronts, stationary fronts and typhoons, implying growth of raindrops. Moreover, statistical analysis using DZ reveals systematic differences in rainfall profiles below a melting layer in tropics where MCSs are primary systems and mid-latitudes where extratropical cyclones and fronts prevail. Therefore, latent-heat profiles and DSDs near surface may be different in these regions as well. Ze profiles above a melting layer in warm frontal stratiform regions are also different from those of tropical MCSs. The difference implies presence or absence of generating cells.